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Screen Printing Electronics

I am sure that people who do not have to write for a living think that we scribes sit with ideas bursting out of our fingertips just waiting for the next opportunity to bore the pants off our readership. Let me tell you this is a fallacy. It is amazing how white an empty page or if you are dyslexic like me the empty screen can be. You cannot believe how liberating the keyboard is, when writing by hand the pen just won't go where the brain wants it to go and reading can sometimes be like a slow motion landslide of words. So why the revelations?

The solution is screen printing, as screen printing played a key role in the creation of word processors and all things electronic. Whilst many of us were happily creating glorious designs in vibrant colours on a host of different substrates there were others taking the screen printing process into areas of engineering excellence that was merely an aspiration for many graphics printers. This was and is in the area of electronic production and the increasingly important markets for fuel cell, solar cell and other energy creating/saving products.

We are fortunate to have in the UK some leaders in the field of electronic production, such as Gwent Electronic Materials Limited, DEK International, BTP Technical Services, Natgraph and several others. What all these companies deal in is precision. When printing any type of electronic circuit the need is for control and repeatability. Screen printing gives the user this and enables large volumes of devices to be printed at relatively high speeds. In this industry screen printing has become known as a Mass Imaging Technology in comparison with digital printing that tends to be used for very short run work. It is quite clear that digital printing technology will increase its applications in this sector but screen printing will continue into the foreseeable future as a frontline production tool at the same time using digital control and stencil imaging technology to streamline the process. This is exemplified by DEK International who produces true state of the art printing equipment to serve the needs of the industry throughout the world.

DEK PRODUCTION LINE



As always the two killers of productivity and profitability are machine down time and rejects DEK address these with their ISCAN™ that stands for Intelligent Scaleable Control Area Network architecture enables intelligent machine communication for complete control and flexibility. This system not only initiates an action but monitors its progress and provides feedback that it records so it is possible to determine the precise conditions that produced a particular lay down of material. DEK use their Instinctiv™ interface to enable the operator to easily control the system. The graphics are gaming quality and can access on line training and process knowledge. Probably the most powerful tool that needs ISCAN™ and Instinctiv™ to operate is their HawkEye™ this is a sophisticated automatic print verification technology that operates at the line beat rate. HawkEye™ can be configured to assess 100% of printed substrates and gives a rapid go/no-go indication for each, meaning that faulty boards can now be automatically isolated in real time.

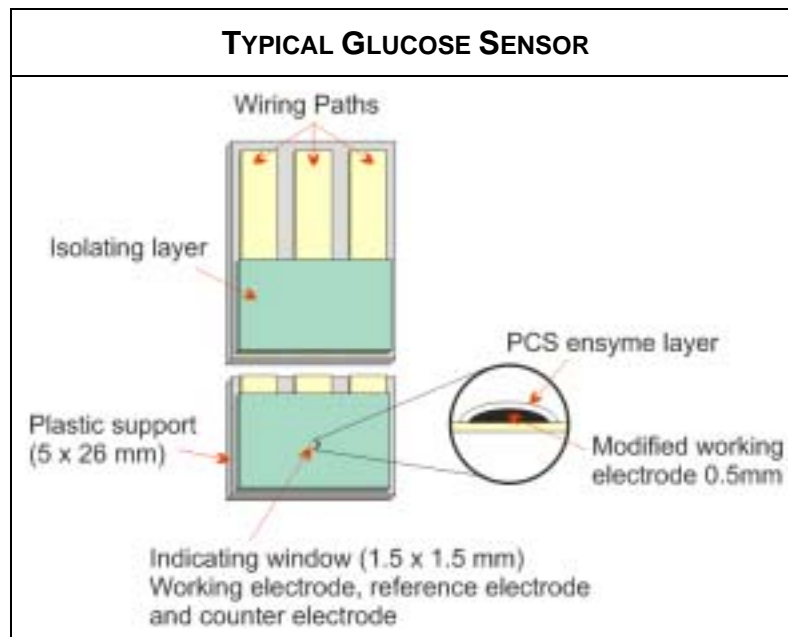
DEK HAWKEYE™



The HawkEye™ verification routine rapidly scans the board as a series of stripes and collects a tightly defined set of monochrome image data. Comparing these results with the user-defined limits of acceptability, HawkEye™ quickly indicates whether the board is ready to pass through to component placement or other downstream processing. The user can also program HawkEye™ to inspect only certain areas of the board where, for example, print deposit density may be particularly high. This allows the user to adjust the total verification cycle time if necessary, and to derive maximum value from the system within the line beat rate. All these capabilities are available in the DEK range of screen printers. Galaxy, Europa and Horizon.

It is Gwent Electronic Materials with its various divisions that supply the solutions/pastes that are printed down. Not so long ago it was just conductive, resistive and insulation (dielectric) that was printed. Now the range of products is increasing as fast as a whole range of technologies develop. So much so that G-E-M have different divisions to suit various applications and have extend their product range into instruments that enclose the sensing technologies in which their products are the core. Just to give you some Idea of the spread of technologies in which GEM are involved. Their product range includes: Enzyme chemistries that have to maintain their efficacy for months and years to precious metal conductors for fuel cell.

As medical technology develops the opportunity for self and remote diagnosis increases. The most common sensing and measurement regime is glucose levels in blood for diabetics.



It is not just human medicine that is adopting sensor technology.

Environmental sensors have been produced to measure pesticide levels in water or other harmful chemicals.

The Agri-Food industry (we used to call it farming) needs to know sugar levels in fruit and vegetables. In this application GEM produces the instruments as well. Both screen printing and flexographic printed are used in producing the sensors. Flexo. tends to be used where very thin deposits are required and screen printing when heavier deposits are needed or the medium can only be screen printed. As mentioned before digital systems are developing but the applications are so numerous there is plenty of room for all processes. As screen printing is an ink friendly process it gives much greater scope for varied chemistries. The substrates that are used as supports for the electronic circuitry are polyester, PVC and alumina a ceramic material.

A typical sensor consists of chemistry, often an enzyme that reacts by changing its electrical characteristic when it comes into contact with the material the system wishes to measure. That enzyme has to be contained and supported and the electrical changes have to be conducted away to a measuring instrument. In essence it is a very simple electronic circuit but the chemistries are extremely complex. The circuitry has to be very reliable and robust. Screen printing is the ideal production tool for many of these applications. Eventually nano-technology will replace this form of sensing with molecular level sensors and we will have quantum computers governing our lives but that is billions of squeegee strokes in the future.

It is easy to forget the longstanding application of screen printing in the production of membrane switches. The technology has not substantially changed in recent years but quality and performance has bounded ahead.



Now with the importance of managing MRSA and other infections these surfaces can be antibacterial. RH Technical Industries provide membrane switches, overlays both plain and backlit with electroluminescence that use these coatings.

Ultra Violet Curing systems for conductive inks are now well established and the cured ink film is much more malleable than the original brittle tracks. Dielectrics (insulators) are often UV systems but resistive systems especially those used in potentiometers are a long way off.

The boundaries between graphics printing and printed electronics are blurring this is exemplified by BTP Technical Services who, like DEK, produce high quality stencils for the industrial and electronics sector. BTP Craftsreen the parent company has been in print for more than 100 years and screen printing for 60 years. It is only 8 years ago that they moved into producing precision stencils for the industrial screen printing market. This required a change in thinking from traditional graphic stencil production to working with very close tolerances where the characteristics of every stencil were measured and recorded. Individual frames have unique identification numbers enabling traceability throughout their useful life.

BTP STENCIL PRODUCTION



Although used to working in clean and tidy conditions it was necessary to move into clean room conditions with fully gowned technicians. Temperature and humidity control is essential to ensure accurate measurement and guarantee complete curing of the emulsions. Dimensional accuracies that were required for printing silicone devices less than 40 mm square are now applied to areas of 400 mm square yet tolerances measured in microns are attainable. It is fundamental improvements in stencil technology like these that are feeding back into graphics screen printing and the techniques employed in graphics for larger formats are migrating to electronics printing.

As more and more complex chemistries are printed so the determining factor as to print speed is drying and curing. Often it is not possible to use just one drying/curing technology. Now combinations of Infra Red, Ultra Violet, Jet Air and Conduction are needed to achieve the desired chemical change. Often refrigeration is necessary to maintain substrate stability. Companies such as Natgraph Limited are leading the world in engineering post processing techniques to answer their client's needs.

So there you are the rambling has nearly finished. It is all thanks to screen printing that I was able to communicate. It will be really interesting to see how the process will evolve in the next ten years. Maybe variable data stencils!